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GLOBAL LINKS AND LOCAL BONDS
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Abstract
This paper examines direct and indirect contributions of foreign firms and small and medium-sized enterprises (SMEs) to aggregate productivity growth. We focus our attention on foreign firms and small firms for three reasons. First, industrial policy in almost all countries is oriented towards supporting SMEs and attracting foreign investment. Second, these two categories of firms contribute to micro-heterogeneity in all industries. Third, the recent industrial dynamics literature on foreign investment and small firms emphasizes the potential benefits of foreign firms and SMEs in generating new technologies, and creating new jobs. Using the data for Turkish manufacturing plants, we estimate production functions for all ISIC 4-digit level industries for the 1983-2001 period. We decompose productivity growth into its components (structural change, entry and exit, technical change, efficiency change, and scale effects) by firm ownership and size. The decomposition analysis by firm ownership and size allows us to understand the sources of productivity contributions by foreign firms and small firms.

Keywords: Productivity dynamics, decomposition, foreign direct investment, small and medium sized enterprises.
Jel Codes: D24, L25, L60

I. Introduction

The role of small and medium sized enterprises (SMEs) in developing economies has been redefined following the major balance of payments crises of the 1970s and the ensuing liberalization efforts. SMEs have become important players in the quest to develop a new environment where innovation, flow of new products and processes continuously re-shape the conditions of the international markets and competition. Moreover, within the new global environment, the ability to attract, absorb and utilize international resources of knowledge has become essential for developing countries to achieve competitiveness in international markets (Lall, 2002). It is thus not surprising that supporting SMEs and attracting foreign investment have become key features of industrial policies adopted by many developing countries.

In line with this shift towards the recognition of foreign firms and SMEs as the engines of growth, recent industrial dynamics literature on foreign direct investment (FDI) and small firms emphasizes the potential benefits of foreign firms and SMEs in generating new technologies and creating new jobs. FDI has always been considered as a major source of new technologies and discoveries, whereas SMEs have been the engine of job creation and poverty alleviation, and a source of diversification and flexibility, which often bridge the development gap within the economy (Borensztein, Gregorio and Lee, 1998; Beck, Demirguc-Kunt and Levine, 2005).

Productivity dynamics in large foreign firms are likely to be different from those in small domestic firms. Small domestic firms usually lack the resources, technological capabilities and market power of large foreign firms. Under the constraints of their relatively low resource base, SMEs are generally less productive and pay lower wages, whereas foreign firms are more productive, and pay higher wages (Baldwin and Dhaliwal, 2000; Balswik and Haller, 2006). The productivity gap between foreign and domestic firms on the one hand, and large firms and SMEs on the other hand are especially wide in developing countries. Firm dynamics in entry and exit are also reported to differ considerably between foreign and domestic firms (Siegfried and Evans, 1994). However, recent evidence also suggests that SMEs are also emerging as internationally active actors, and are the driving

force for substantial share of export growth, indicating that they may bring up more dynamic patterns of productivity growth (OECD, 1997).

The role of disparity between the productivity, size and wage characteristics and the emphasis on the role of the dynamics of foreign firms and the SMEs in generating economic growth build a subject worthwhile inspecting. This study, within the context of Turkish manufacturing industry, examines the effects of foreign firms and SMEs on productivity growth from 1983 to 2001. With the onset of structural reforms in January 1980, Turkish economy has experienced a major transformation from domestic demand oriented, import-substituting industrialization to one with export-oriented growth and integration with the global commodity and financial markets. Thanks to significant improvements in productivity, the manufacturing industry has become the sector that led the outward-orientation of the economy. It is therefore important to depict and decompose the ever-evolving characteristics of the productivity dynamics of the manufacturing industry with respect to firm size and ownership.

To this end, we estimate production functions for all ISIC 4-digit level industries by using plant level panel data for the 1983-2001 period. Our estimation methodology allows us to decompose productivity growth into its components (structural change, entry and exit, technical change, efficiency change, and scale effects) by firm ownership and size. We further estimate a fixed-effects regression model to have an understanding of the major factors affecting productivity.

Section 2 provides a brief summary of developments in the Turkish economy since the early 1980s and discusses the dynamics of the manufacturing output and productivity over the same period. In Sections 3 and 4 we focus on the productivity growth performance of the Turkish manufacturing industries during the 1983-2001 period. The decomposition exercise in Section 3 reveals that the productivity growth in Turkish manufacturing has shown substantial differences over time and across different groups of firms. In Section 4, we use fixed effects regression to determine the factors that had significant influence on labor productivity growth. Finally, Section 5 summarizes the results and concludes the paper.

II. Dynamics of the Turkish Manufacturing Industry

Similar to many other developing countries that adopted import-substituting industrialization strategy in the 1960-70s, Turkey had run into a serious balance of payments crisis by the late 1970s. In January 1980, the government launched an IMF-backed stabilization program. The immediate objective of the program was to stabilize the economy by improving the balance of payments and bringing the inflation under control. The long-term goal, however, was more ambitious: to liberalize the Turkish economy and change its structure fundamentally through an "export-oriented" industrialization strategy.

During 1983-2001, Turkish economy has experienced distinct cycles of boom and bust. The "1983-87", "1989-93" and "1995-97" periods are identified by rapid growth of output. The period 1983-87 was marked with trade liberalization and export promotion along with a set of structural adjustment measures aimed at the stabilization of the macroeconomic environment. During this period, export revenues increased at a rate of 10.8% per year and the average annual rate of output growth was 6.4%[1]. Although the average annual rate of growth of total fixed investment was 8.9%, manufacturing investment dwindled with negative growth rates, especially towards the 1988 downturn.

The period thereafter is marked as the second phase of outward-orientation of the economy along with a growth fuelled by rising public sector expenditures and fiscal deficits. As domestic financial markets proved insufficient in debt finance of fiscal deficits the government in power decided to liberalize the capital account in August 1989, albeit immaturely. This decision defined another turning point for the integration of the Turkish economy with the global commodity and financial markets. The annual rate of growth of GDP averaged 5.2% during 1989-93, under the conditions of a fully-open economy. During this period, manufacturing investments peaked at an annual average rate of growth of 15.9%.

In the second half of the 1980s, the government also issued decrees to remove some of the barriers to foreign direct investment (FDI). As a result, the FDI flows increased above

[1] Starting from 1984, export-oriented policies had been coupled with a general reduction in tariff and non-tariff barriers and finally culminated in the Customs Union with the European Union in 1996. As part of the efforts to increase exports, the government allowed Turkish Lira to depreciate by 36% in real terms from 1980 to 1988.

dismally low annual levels of 110 million dollars between 1980-87 to 354 million dollars in 1988 and to 684 million dollars in 1989.

The decision to liberalize the capital account meant to move away from an exchange rate policy that was geared to promote exports, towards the one that viewed exchange rate as an implicit anchor to inflation. This new function of the exchange rate was also enforced by portfolio capital inflows that lead to real appreciation of the Lira. As a result, the Lira had appreciated by 18% between 1988 and 1993, before the maxi devaluation of 1994. This period of expansion was interrupted by the financial crisis in January 1994 where GDP fell by more than 6.0% and manufacturing investment contracted by 10.8%.

Following less than a year of fiscal austerity, the government increased its expenditures and continued to run fiscal deficits again. As a result, the average annual rates of growth of output and investments increased to 6.8% and 8.0%, respectively, in the next five years. Yet, as major macroeconomic reforms were postponed indefinitely, high inflation and macroeconomic instability had become the major characteristics of the Turkish economy in the 1990s. The frequency and the size of the boom-bust cycles amplified. 1994, 1999 and 2001 are clear points of trough in which real GDP contracted by 6.1%, 6.1% and 9.5%, respectively.

The statistics on FDI inflows during the 1990s provide additional evidence about the role of the macroeconomic environment. Throughout the 1990s, a period during which the global capital flows increased exponentially, Turkey was not able to attract foreign direct investment to the same extent. The average annual FDI inflows during the 1990-2001 period was below US$ 1 billion.

As reflected in output growth, productivity, trade orientation, employment and remunerations, the dynamics of the manufacturing sector paralleled that of the overall economy. In order to portray a broad overview of the production/productivity dynamics of the manufacturing sector, Figure 1 illustrates the data on manufacturing output for the 1983-2001 period. The figure indicates that the manufacturing output has roughly tripled throughout the period. The pace of output growth is much higher in the early 1990s, yet much volatile, especially after 1994. The contractionary effects of the 1994, 1999 and 2001 crises are all observable in the figure.

Concomitant with the increase in output, the level of inputs (intermediate inputs) also displays an increasing pattern during the period. The growth rate of inputs tends to be higher than the growth rate of output, notably after 1994. The input/output ratio, which was around 53% in 1983, increased to 55% in 1994 and to 61% in 2000, just before the 2001 crisis.

Manufacturing employment, which showed a steady upward trend during the 1980s, has been quite unstable since then. Figure 2 demonstrates that the number of production workers and administrative employees declined during the 1989-1993 expansionary cycle, hitting its low in 1994.[2] There was a sharp increase in employment after the 1994 crisis until 1999. Following the 1999 downturn of the economy, total employment in manufacturing has once again declined sharply.

As for the categories under concern, Figure 3 illustrates the manufacturing value added shares with respect to size and ownership of firms. Large scale enterprises (LSEs) produced the highest share of value added in total manufacturing[3]. Their share in manufacturing output was around 70% throughout the 1980s. The value-added share of LSEs decreased to an average level of 50-55% by 2000. The declining share of the LSEs in value added was replaced by the increased share of SMEs in part, but more than that by the increased share of foreign firms. The share of foreign firms in total value added was on the order of 12-13% at the beginning of the period. It showed a gradual increase and doubled throughout.

The employment share of SMEs, then again, is observed to stay around 30% during the 1980s and 35% during the 1990s. In the meantime, from an initial level of 6%, the employment share of the foreign firms almost doubled in two decades. The larger domestic firms that experienced continuous reduction in value added share throughout the 1990s

[2] In ongoing work we show that the private sector responded to the rapid wage hikes of late 1980s by reducing employment and increasing productivity (see Taymaz, Voyvoda, and Yılmaz, 2010).
[3] LSEs (SMEs) are defined as domestic firms employing more (less) than 150 employees. "Foreign firms" are defined as those joint ventures where foreign ownership is 10 % or more. Foreign firms are not classified by size because most of them are large. The statistical unit used in this study is the "establishment". The "establishment" is defined by the Turkish Statistical Institute (Turkstat) as a "functional and decision-making unit that operates at a single location". Throughout this study, we use the terms "firm" and "establishment" synonymously.

also displayed a reduction in their employment shares. The relatively higher employment share of SMEs in comparison to their share in total value added is a common characteristic of manufacturing industry in many developing economies, and this phenomenon reflects the fact that SMEs are, on average, less productive than LSEs (see, for instance, Perez and Stumpo (2000) for the corresponding figures for most Latin American countries).

Foreign firms, on average, have larger size, use more capital intensive technologies and are more productive than the domestic firms, a characteristic observed in most developing countries. Figure 4 displays the data on real labor productivity for foreign firms, SMEs and LSEs throughout 1983-2001. The difference in average real labor productivity between foreign firms and SMEs is large. The productivity gap between foreign firms and SMEs is observed to get even larger throughout the 1990s and especially after the 1994 crisis.

Foreign firms, on average, paid higher real wages than LSEs and SMEs throughout 1983-2001. Yet, the patterns of real wages for different groups of firms are similar. Manufacturing real wages were reduced until 1988, and showed an upward swing between 1988 and 1993. In this period, the manufacturing real wages almost doubled for the SMEs, and increased by 150% for foreign firms. Such an upward trend was interrupted by the 1994 crisis. The real wages started to increase gradually through the end of 1990s. It is the 2001 economic crisis that has once again put manufacturing real wages on a downward trend.

III. Components of Productivity Growth: A Decomposition Analysis

Data

In the previous section we briefly reviewed macroeconomic developments over the 1983-2001 period and highlighted major trends in employment, output and productivity of foreign firms, LSEs and SMEs in Turkish manufacturing. In this section we estimate translog stochastic production frontiers of 61 ISIC-4 digit manufacturing industries to obtain labor productivities at the sectoral level. By using the estimated parameter values of

the production frontier, we will decompose productivity growth into its components to shed light on the productivity dynamics.

In our empirical analysis we use the Industrial Statistics Database collected by the Turkish Statistical Institute for the manufacturing industry. The survey covers all public establishments and private establishments that employ 10 or more people. There are about 10,000 plants per year in the dataset. The dataset includes information about production, inputs, investments, employment structure, wages, technology transfer and ownership.

Framework and the Method

The translog stochastic production frontier is defined as follows:

$$\ln y_{ft} = \alpha_0 + \sum_i \alpha_i \ln x_{ift} + \sum_t \lambda_t D_t + \sum_i \beta_{Ti} t \ln x_{ift} + \tfrac{1}{2} \sum_i \sum_j \beta_{ij} \ln x_{ift} \ln x_{ift} + \varepsilon_{ft} - v_{ft} \quad (1)$$

where the subscripts *f* and *t* indicate establishment and time, *y* is the output (output deflated by a sectoral price index) , D_t is the time dummy variable, x_i is the vector of inputs and the subscripts *i* and *j* index inputs: *K* (real capital stock, calculated by the perpetual inventory method at the firm level); L^P unskilled labor (number of production workers); L^A skilled labor (number of administrative employees); *E* energy (real value of energy expenses); and *R* raw materials (the cost of raw materials and intermediate products deflated by a sectoral input price deflator). The random errors (ε) are assumed to be independently and identically distributed as $N(0,\sigma_\varepsilon^2)$ and independent of the v-terms which measure firm-specific technical inefficiency in production. The technical inefficiency term (the v-term) is assumed to be drawn from a truncated normal distribution with a firm-specific mean, μ_{ft}, and a common variance σ_v^2. The mean inefficiency term is assumed to be a linear function of firm-specific factors (for the specification of the model, see Battese and Coelli, 1995).[4] The stochastic production frontier and efficiency effect model were estimated simultaneously by maximum likelihood method (Coelli, 1994).

[4] The firm characteristics that are included as explanatory variables in the efficiency effects model are regional agglomeration, real wages, the share of skilled workers, foreign ownership, public ownership, subcontracting relations, and technology transfer status. For data sources and estimation results, see Taymaz, Voyvoda and Yilmaz (2008).

Our estimation method allows us to decompose productivity growth at the manufacturing industry level into three major components: i) *firm demography* (the contribution of firm entry and exit); ii) *between* (the contribution of structural change through reallocation of resources among the existing firms and sectors); and iii) *within* (the contribution of the productivity changes of the existing firms).

Clearly, aggregate/industry level productivity increases if the productivity of individual firms increases (the *within* effect). Yet, it is also possible to observe aggregate productivity growth if resources are conveyed towards more productive firms with from loss productive firms (the *between* effect). At the same time, average productivity of the entering and exiting firms also matter (*firm demography*).

Among several alternative approaches to the decomposition of productivity growth we follow the one that is suggested by Griliches and Regev (1995), where labor productivity growth is decomposed into four components as follows[5]:

$$(P_t - P_{t-1}) = (Q/L)_t - (Q/L)_{t-1} = \sum_{i \in I} p_{i,t}\omega_{i,t} - \sum_{i \in I} p_{i,t-1}\omega_{i,t-1} =$$

$$\sum_{i \in C} \Delta p_{i,t}\overline{\omega}_{i,t} + \sum_{i \in C} \Delta\omega_{i,t}(\overline{p}_{i,t} - \overline{P}_t) + \sum_{i \in E} \omega_{i,t}(p_{i,t} - \overline{P}_t) - \sum_{i \in X} \omega_{i,t-1}(p_{i,t-1} - \overline{P}_t) \qquad (2)$$

Here, P_t denotes the industry-level labor productivity at time t and $p_{i,,t}$ is the plant-level labor productivity. Thus, P_t-P_{t-1} indicates the aggregate productivity change. $\overline{p}_{i,t}$ and $\overline{P}_t$ represent the average values for the periods *t-1* and *t*. *I* stands for the set of all firms in the sample, *C* the set of surviving firms (those who stay in the sample from period *t-1* to period *t*), *E* the set of entering firms at time *t* and *X* the set of failing (exiting) firms at time *t*. $\omega_{i,t}$'s denote employment shares.

As shown in Equation (2), the aggregate labor productivity growth is equal to the average labor productivity growth of the firms, weighing each individual measure by its labor share. This term is represented in the first line of the equation. The first term in the second line of the equation stands for the *within* effect; it measures the contribution of productivity

[5] Baldwin and Gu (2006) and Griffin and Odaki (2009) provide a summary of different methods of decomposition of productivity growth.

changes of the firms staying in the sample from period *t-1* to period *t*. The second term is the *between* effect: it sums changes in productivity due to reallocation effects. The next two terms determine the contributions of entrants and exitors to the aggregate productivity growth. The entry (exit) effect will be positive if entrants are more (less) productive than the average.

Since the focus of this study is on the contributions of both SMEs and foreign firms to aggregate productivity, the same decomposition method is to be utilized for these two groups of firms as well (de Backer and Sleuwaegen, 2003). In other words, it is possible to separately define *C*, *E* and *X* for these three categories of firms.

A significant extension of the decomposition method outlined above is to further decompose the *between* and *within* effects into their sub-components (see Figure 5). The *between* effect is decomposed into *inter*-industry and *intra*-industry allocation effects as follows:

$$\sum_{i\in C}\Delta\omega_{i,t}(\overline{p}_{i,t}-\overline{P}_t)=\sum_{i\in F_j}\sum_{j\in S}\Delta f_{i,j,t}\overline{s}_{j,t}(\overline{p}_{i,t}-\overline{P}_t)+\sum_{i\in Fj}\sum_{j\in S}\Delta f_{j,t}\overline{s}_{i,j,t}(\overline{p}_{i,t}-\overline{P}_t) \qquad (3)$$

In this equation, s_j*'s* denote the share of the j^{th} industry in total manufacturing employment, and $f_{i,j}$ the employment share of the i^{th} firm in j^{th} industry, i.e., $\omega_i = f_{i,j}s_j$. S denotes the set of industries (defined at the ISIC 4-digit level), and F_j represents the set of firms in the j^{th} industry. The first term in the right hand side of the equation shows the effects of intra-industry reallocation (changes in the employment shares of firms within their own industries), whereas the second term shows the effects of inter-industry allocation (changes in the employment shares of industries within manufacturing).

Following the stochastic frontier analysis literature, we have decomposed the productivity growth of individual firms (the within effect) into four sub-components[6]: i) input intensity, ii) economies of scale, iii) technical efficiency, and iv) biased and neutral technological change (Figure 5). It is possible to identify these four sub-components at the firm level as follows:

[6] For a set of contributions see, Nishimizu and Page (1982); Kumbhakar (2000); Kim and Han (2001) and Liao *et al.* (2007).

$$
\begin{aligned}
p_t - p_{t-1} &= (q_t - l_t) - (q_{t-1} - l_{t-1}) = \overline{\varepsilon}_K \left[(k_t - l_t) - (k_{t-1} - l_{t-1})\right] \\
&+ \overline{\varepsilon}_M \left[(m_t - l_t) - (m_{t-1} - l_{t-1})\right] + \overline{\varepsilon}_E \left[(e_t - l_t) - (e_{t-1} - l_{t-1})\right] + \\
&\overline{\varepsilon}_{\mathrm{Pr}} \left[(pr_t - l_t) - (pr_{t-1} - l_{t-1})\right] + \overline{\varepsilon}_A \left[(a_t - l_t) - (a_{t-1} - l_{t-1})\right] \\
&+ (\overline{\kappa} - 1)(l_t - l_{t-1}) + (TE_t - TE_{t-1}) + \left[(\alpha_t - \alpha_{t-1}) + \sum_n \beta_n \overline{x}_n\right]
\end{aligned}
\tag{4}
$$

Equation 4 defines the (log) labor productivity growth at the firm level. By definition, it is equal to output per labor (q_t and l_t denote (log) output and labor at time *t*). $\overline{\varepsilon}_K$, $\overline{\varepsilon}_M$, $\overline{\varepsilon}_E$, $\overline{\varepsilon}_{\mathrm{Pr}}$ and $\overline{\varepsilon}_A$ are the elasticities of output with respect to capital (K), intermediate inputs (M), energy (E), production workers (Pr) and administrative employees (A) averaged over *t-1* and *t*. the corresponding lower case letters indicate the log each input. The first term of the summation indicates the contribution of the change in capital intensity on labor productivity growth. Terms in the second line capture the contribution of increases in the intensity of intermediate inputs and energy on labor productivity growth. Terms in the third line measure the effect of changes in the composition of employment on labor productivity growth. The next term measures the contribution of returns to scale. Under increasing returns to scale ($\kappa > 1$) technology, increasing the levels of all inputs will lead to a higher rate of output growth, contributing positively to productivity growth. Similarly, increases in technical efficiency ($TE_t - TE_{t-1}$) will add positively to labor productivity growth. The last term in the equation illustrates the effects of neutral and biased technological change.

Components of Productivity Growth in Turkish Manufacturing

Table 1 summarizes the results of the labor productivity decomposition exercise for the Turkish manufacturing industry for three sub-periods, 1983-1988, 1988-1993 and 1995-2000, two crisis years (1993-1994 and 2000-2001), and one recovery period (1994-1995). Each cell of the table denotes the average value of the corresponding variable over the associated sub-period.

Parallel to the growth and recession cycles of the economy, Turkish manufacturing industry, as a whole, illustrates volatile average growth rates for labor productivity (see the last column of Table 1).

Overall, we observe that the Turkish manufacturing industry has shown quite a volatile performance in terms of productivity growth since the early 1980s. Average labor productivity growth rate was 6.1% in 1983-1988; it increased to 9.9% over 1989-1993 and then declined to 2.6% in 1995-2000. The bulk of growth in aggregate labor productivity is accounted for by the *within* effect. The most important sub-components of the within effect were the change in intermediate input intensity and technical efficiency. During the 1994-2001 period, which was marked by abrupt boom and bust cycles, the manufacturing industry productivity growth performance was the poorest (annual growth rate of real labor productivity was on the order of 1.8% on average).

The contribution of the *within* effect to overall productivity growth has been over 60% during 1983-1988, 1988-1993 and 1995-2000 periods. The within effect has significant negative contribution during economic crises as a result of sharp decline in output and productivity. The intra-industry *between* effect also shows positive contribution in all periods with the exception of the 1994 crisis. The positive contribution of the intra-industry *between* effect implies that more productive firms tend to increase their market shares. Hence, the selection process among the manufacturing firms has played a significant role in labor productivity growth.

The above results are in line with the ones reported for other countries: the within and between components are reported to be the most significant contributors to productivity growth for US manufacturing firms between 1977-1987 (Foster, Haltiwanger and Krizian, 2001). Similarly Griffin and Odaki (2009) note that the within effect is the single most important contributor to the slowdown of total factor productivity growth in Japanese manufacturing during 1990s. The within component accounts for almost 50% of the labor productivity growth for the UK manufacturing firms in 1980-92 and together with the between component explains almost all the productivity growth of labor (Disney, Haskel and Heden, 2003). The inter-industry *between* effect has a negative contribution in all time periods, and its negative effect tends to increase over time. This finding suggests that, contrary to many fast-growing countries like Korea, the structure of the Turkish manufacturing industry has evolved towards *less* productive sectors during the period of analysis.

Except for the export-oriented growth period of 1983-88, we observe that the effect of firm entry is negative throughout the period. This indicates that, entering firms, on average have lower productivity. On the other hand, exit effect is relatively strongly positive in all periods, leaving a positive net entry effect. It is possible to suggest that the selection process in the Turkish manufacturing industry works by eliminating less productive firms, especially after the 1994 crisis. The incidence of entry/exit episodes and their contribution to the productivity growth increased considerably during the boom and bust cycles throughout the 1990s, with a declining rate of productivity growth. These asymmetries in the contribution of entry and exit dynamics to overall productivity growth are also in line with the results reported by Haltiwanger (1997) for US manufacturing in 1972-1988. On the other hand, Van Biesebroeck (2006) reports a negative exit effect for the Colombian manufacturing firms for 1977-87 period.

In order to understand the extent of firm heterogeneity (in term of size and ownership) contributes to industry-wide result, Table 1 also reports the results of the decomposition exercise for each category of firms (SMEs, LSEs and foreign firms). Large differences in productivity growth rates achieved by these three groups of firms are evidence of substantial degree of heterogeneity among the manufacturing firms. SMEs have achieved, on average, the lowest productivity growth rates, whereas foreign firms performed even better than large domestic firms in all but the 1988-93 period. Interestingly, foreign firms seem to be less flexible in terms of maintaining the labor productivity growth rates than domestic firms, and they were hit the hardest during economic crises of 1994 and 2001.

Examining the elements of productivity growth for foreign firms and the SMEs, we observe that these groups differ considerably both in terms of their labor productivities and in terms of the characteristics of their contributions to the aggregate labor productivity growth. The contribution of SMEs to aggregate labor productivity has been quite low (8%) during the 1983-1988 period (the "Total" column in the "SMEs" panel in Table 1). It should be noted that half of this contribution is due to the *within* effect and the other half is due to the *intra-industry between* effect. The contribution of SMEs to total productivity growth is observed to increase to 20% in 1988-1993 and 35% in 1995-2000 periods. On the other hand, the contribution of foreign firms which had been historically significantly higher than that of SMEs continued to increase during the period. The contribution of foreign firms to aggregate labor productivity growth was on the order of 28% in 1983-88.

Their role has increased to 32% in 1994-95 and to 39% in 1995-2000. The LSEs, throughout the period has shown constant reduction in their contribution to productivity growth. Such observations indicate that the productivity dynamics within different groups can be of completely different nature.

In both the 1988-93 and 1995-2000 periods, the most significant component of labor productivity growth of the SMEs appears to be the *within* effect. The structure of the entry/exit components of productivity growth notably points to the dualistic pattern of the SMEs in their contribution to economic growth in Turkish manufacturing. The high growth periods of 1988-1993 and 1995-2000 improved the conditions for new SMEs to enter the industry. However, as productivity levels in entering SMEs were considerably low, the entry effect on aggregate productivity growth turn out to be negative. This negative contribution was however counterbalanced by the exit of domestic firms operating at lower productivity levels. The selection process seems to be working in manufacturing industry ; the exit effect contributes positively to aggregate productivity, indicating that the SMEs with productivity levels lower than the average tend to exit the market. This effect becomes especially sizeable during the 1995-2000 period and the 2001 crisis.

In the case of foreign firms the entry term is positive, indicating that foreign firms are more productive than the average firm even at the time they first enter the market. Entry by foreign firms leads to an increase in average productivity. On the other hand, the lower productivity of entering and exiting domestic firms (SMEs and LSEs), a result which is also reported in previous research is largely consistent with a process of noisy selection and passive learning. While domestic firms entering the market realize their own potential over time, foreign entrants do not have to go through this learning process. Such typology is also conveyed by supporting empirical research: Baldwin and Gu (2006) report that the plants opened up by foreign controlled firms in Canadian manufacturing industry are typically much more productive than those by domestically controlled firms.

Baldwin and Gu (2006) also state that exiting foreign firms were on average almost twice as much productive as their domestic counterparts. This result is not valid for the Turkish case. In our labor productivity decomposition analysis, the exit term for foreign firms is close to zero for all sub-periods considered, except for the 2001 crisis. The exit of some foreign firms from the manufacturing industry does not lead to an increase or decrease of

the aggregate productivity growth. The exit effect during the 2001 crisis was negative and quite large, i.e., foreign firms exiting the market in 2001 were on average more productive than the average firm in the market, therefore their exit dragged the productivity growth down. This finding however is in contrast with the findings of other developed countries (Haltiwanger, 1997; de Backer and Sleuwaegen, 2003

Overall, the contribution of foreign firms to aggregate productivity growth has been around 30% on average (28 % in 1983-1988, 21% in 1988-1993, and 39% in 1995-2000). Foreign firms experienced the highest productivity growth rate in 1983-1988 period (8.9%), after which they went through a period of declining productivity growth rate in 1988-1993 (6.7%), and, as is the case for SMEs, in 1995-2000 (3.4%). Similar to that of SMEs, the most important factor behind foreign firms contribution to productivity growth is the *within* effect, i.e., continuous improvements of productivity by surviving firms. Therefore, in order to understand the sources of productivity growth, we need to analyze the components of the *within* effect in detail.

Decomposition of the Within Effect

Since it is the *within* effect that captures the majority of the growth in aggregate labor productivity throughout the whole period, we now turn to the analysis of the decomposition of the *within* effect into its components (See Table 2). The last column of the table indicates the average annual labor productivity growth of the corresponding group-period pair.[7] As noted in the previous section, the *within* effect is decomposed into four sub-components: i) input intensity, ii) economies of scale, iii) technical efficiency, and iv) technological change. The results are tabulated for each of the inputs included in the estimation of the production functions. The effect of technological change is further sub-columned in neutral and biased components.

The within-component of labor productivity growth in each sub-period shows similarity with the overall productivity growth rate presented in Table 1. The within-firm labor productivity growth, measured to be 3.3% in the 1983-1988 period, increased to 9.3% during the high-growth episode of 1988-1993 before decreasing to a very low level (1.8%)

[7] The figures correspond to average productivity growth rate of the firms that stay in the sample at time *t-1* and *t*, i.e. these are the averages for the firms in set *C*.

during the 1995-2000 period. In all sub-periods the most important sub-component of the within effect was the change in intermediate input intensity, followed by technical efficiency and the neutral technological change and energy intensities. The change in capital intensity had also important contributions to within-productivity growth, especially for LSEs and foreign firms. The contribution of the changes in the composite labor intensity is small and does not reveal any pattern. It seems that changes in composite labor intensity had a small negative impact on within productivity growth for foreign firms especially since the early 1990s.

The contribution of returns to scale is also minor for all groups of firms, in all periods. Such a finding is in line with mostly constant returns to scale property of the estimated production frontiers. The contribution of the change in technical efficiency is highly significant, and show quite diverse effects in different sub-periods. Over the period 1983-1988 and during the 1994 and 2001 crises, technical efficiency component had a negative effect on firm-level labor productivity growth, both for the foreign and domestic firms. However, for all firms but especially for LSEs, the contribution of this component turns out to be considerably positive in 1988-1993 and 1995-2000 periods.

Over the analysis period of 18 years, the effect of technological change is found to be surprisingly limited for Turkish manufacturing industry. This result is clearly opposite to what has been obtained in the analyses of manufacturing industries in many developed and developing countries. The contribution of average technological change is observed to be negative for the 1983-1988 period (almost -17%, due to neutral technical change). In the 1988-1993 period, both neutral and biased technological change contributed positively to overall productivity growth. From 1994-onwards, with very low rate of productivity growth, we observe that the contribution of technological change is mostly negative or insignificant.

IV. Sources of Productivity Growth in Turkish Manufacturing

The previous section has portrayed that the productivity growth performance of the Turkish manufacturing industries during the 1983-2001 period has shown substantial

differences over the sub-periods and over different groups of firms as defined. The different trends observed in productivity growth definitely result from the interaction of different factors at the aggregate, sectoral and firm levels. These factors may include macroeconomic conditions, the depth and complexity of the industrial structure, openness to international competition, cost structure of the firms, etc. One of the crucial issues in productivity analysis is to identify factors that affect productivity growth. For this purpose, this section presents the results of a fixed-effects regression model to determine the sources of productivity at establishment level in Turkish manufacturing.[8] Table 3 summarizes the characteristics of the variables used in the analysis and Table 4 presents the model estimation results for all firms and for domestic and foreign firms separately.[9]

The estimation results invariably show that the openness variables included in the model to capture the effects of outward-orientation and international competition are rather influential on productivity growth in Turkish manufacturing industries in 1983-2001. The tariff rate variable, which captures the effect of foreign competition due to imports, is observed to have a significant effect on labor productivity. One point reduction in tariff rate increases labor productivity by 0.4%-0.54% under output and by 1.3% under value added specifications. Similarly, the import ratio (import value/value of domestic sales) has a statistically significant positive effect on labor productivity. It appears that the increased import ratio from its level of 14% in 1983-88 to 19.5% in 1994-2001 led to a 1% increase in labor productivity in Turkish manufacturing. These results complement the other studies revealing the significant effect of the increased competitive pressure through imports on total factor productivity growth in the Turkish manufacturing plants (Ozler and Yilmaz, 2009). The positive effect of reduction in tariff rates on productivity is even stronger for foreign firms; yet another indicator that the plant ownership heterogeneity is closely related to differentiated productivity response to tariff liberalization. In the context of developing countries, Fernandes (2007), Muendler (2004) and Schor (2004) also report the reduction in tariff rates being effective in rising productivity for Colombian and Brazilian manufacturing firms.

[8] Labor productivity is used as the dependent variable of the estimated model and is defined in terms of (log) output per employee. The results do not show any significant difference when (log) value added per employee is used as the dependent variable.

[9] Following the argument that the determinants of productivity growth may differ for young (firms that are less than 5 years old) and mature firms (firms that are more than 5 years old), we have also estimated the same model for the set of mature firms only. The main results do not change..

The next variable denoting the effect of international competition on productivity is the export ratio (value of exports/value of production). The export ratio is one other factor that is effective in determining the level of labor productivity, yet, under both specifications of labor productivity, the magnitude of its effect is much smaller than that of the import ratio for domestic firms and is insignificant for foreign firms.

Foreign firms are generally much larger in size, use more capital-intensive technologies, are more productive and pay higher wages than most domestic firms in developing countries. With such characteristics, the expectation from the existence of foreign firms in manufacturing industry is that they serve as a source of technology spillovers for the domestic economy. Moreover, the fierce competition environment created by the existence of foreign firms is expected to generate an operational pressure on domestic firms to increase their productivity. The variables representing the existence of foreign firms in Turkish manufacturing show that the share of foreign firms in total output increased considerably at both regional and sectoral levels throughout 1983-2001 (Table 3). Yet, contrary to expectations, both variables have negative coefficients in the estimated model. The regional share of foreign firms has all negative coefficients in determining labor productivity. It seems that FDI does not appear to generate positive spillover effects for domestic firms in the same industry or same region. Roberts and Tybout (1997) emphasize that foreign firms may be drawing off demand and high-quality labor away from domestic firms (at least in the short run) as they observe a similar outcome for Chile, Colombia and Morocco. Such results may also indicate that most foreign firms with their enlarged market shares in the sectors they operate force an environment where the SMEs operate under low productivity and low efficiency levels. These results are in line with the findings of other studies on Turkey (Lenger and Taymaz, 2006).

Regional concentration variable defined as the proportion of the output of the region in which the firm is located to total output, is expected to pick up the effect of agglomeration and urbanization externalities on productivity. Under the estimated model, the coefficients of this variable point to significant and negative effect on labor productivity for domestic firms.

Together with the foreign trade variables, the effect of real wages on productivity seems to be the most significant. The 71% (cumulative) increase in real wages over the 1983-2001

period is observed to be one of the factors contributing to labor productivity growth (by 14%). One point increase of real wages in the previous period increases real labor productivity in the current period by 0.21%.

Concluding, opening up to foreign competition seems to have positive effects on firm level productivity in Turkish manufacturing over the 1983-2001 period. The contribution of increasing real wages is also positive. Neither the increased share of foreign firms, nor the existence of sub-contracting had positive contributions on labor productivity.

V. Conclusions

In this paper we examined the contribution of foreign firms and SMEs on productivity growth in Turkish manufacturing in the 1983-2001 period. The detailed decomposition analysis on the sources of productivity growth by firm ownership and size has provided very rich information about the size and mechanisms of the contributions made by foreign firms and SMEs.

Our findings indicate that structural change played an important role in increasing productivity in the 1980s and early 1990s. The process of allocating resources towards more productive firms (positive intra-industry allocation effect) worked well especially in the period after the 1994 crisis which is characterized by boom and bust cycles and unsustainable macroeconomic uncertainty, but Turkey's specialization in less productive sectors (negative inter-industry reallocation effect) eliminated some of productivity improvements. SMEs' contribution to productivity growth was limited during the periods of rapid growth (1983-1988, and 1988-1993), but it increased substantially in the last period (1995-2000), partly because of the sustained within-firm productivity growth achieved by SMEs, and partly because of the market selection process that eliminated less efficient SMEs rather quickly.

Foreign firms contributed to almost one quarter of the growth in manufacturing productivity in the last two decades, and this ratio is slightly higher than foreign firms share in manufacturing output. In other words, foreign firms' contribution to productivity

growth is not significantly different from that of domestic firms. Although foreign firms, on average, are more productive than domestic (large) firms, they did not achieve higher productivity growth rates.

Our findings from econometric analysis on the determinants of productivity growth reveal that competition in international markets are important in raising productivity, either through forcing firms to be more productive, or through eliminating less productive firms. All international competition-related variables (import penetration ratio, export intensity, and tariff rates) have expected productivity-enhancing effects. The existence of foreign firms in the domestic market, neither their share in sectoral output nor their share in regional output, has any positive effect on productivity, i.e., the nationality of producers in the domestic market does not matter.

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Figure 1. Manufacturing output, 1983-2001

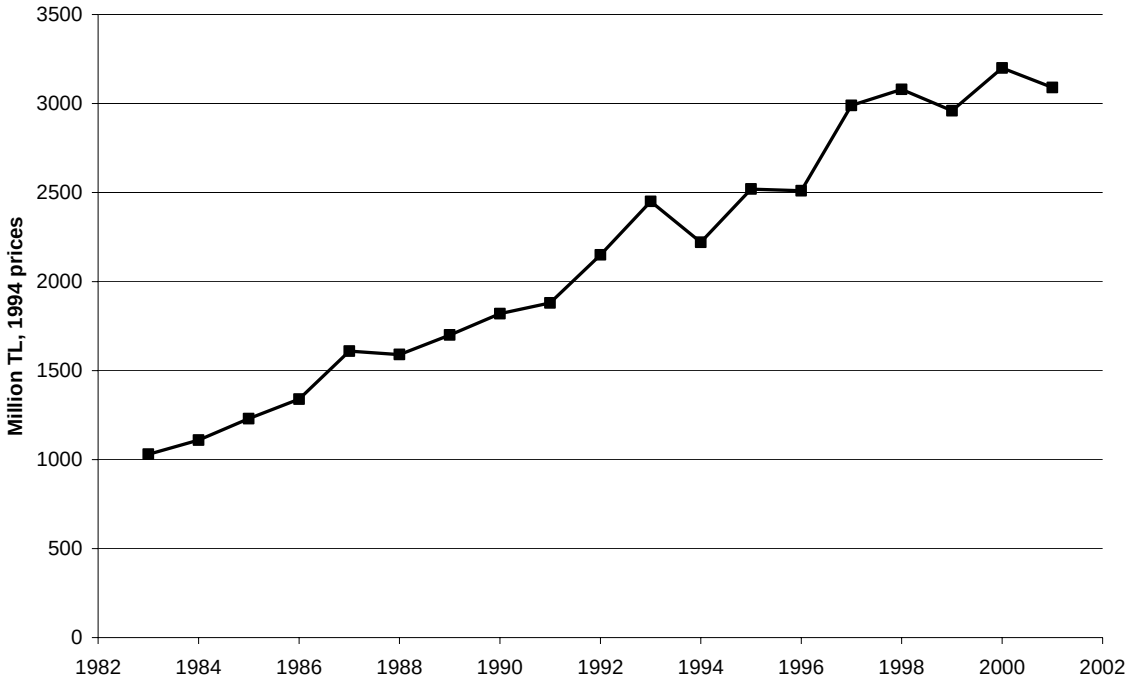

Figure 2. Number of employees in manufacturing, 1983-2001

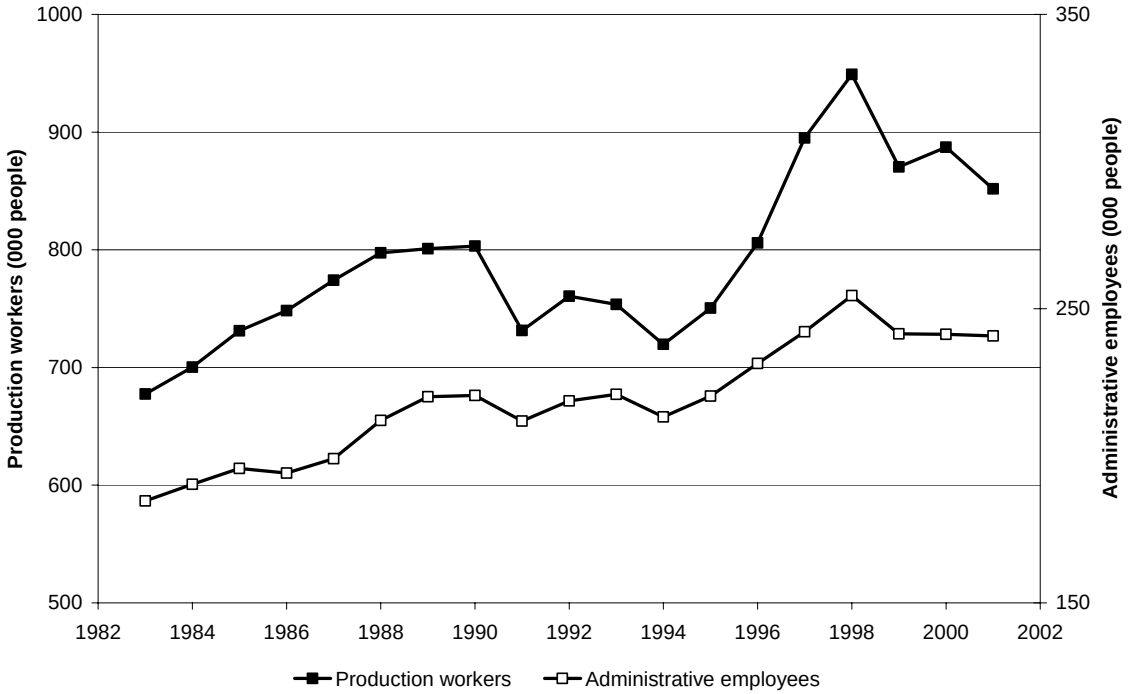

Figure 3. Distribution of value added by firm type, 1983-2001

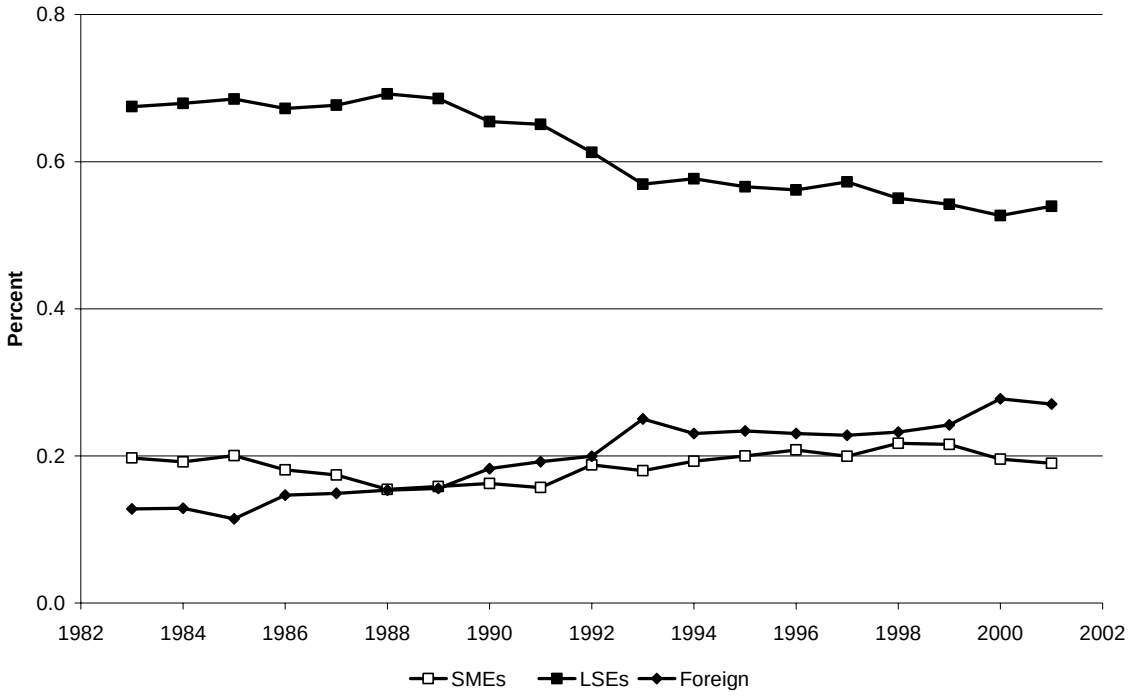

Figure 4. Labor productivity by firm type, 1983-2001

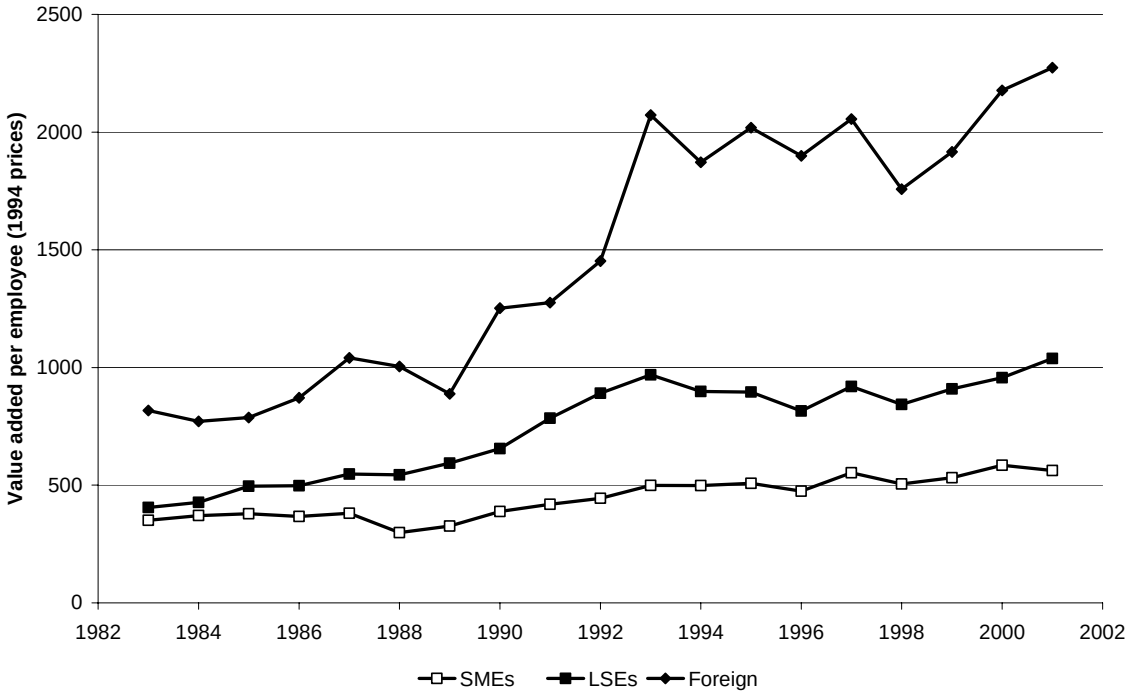

Figure 5. Sources of productivity growth

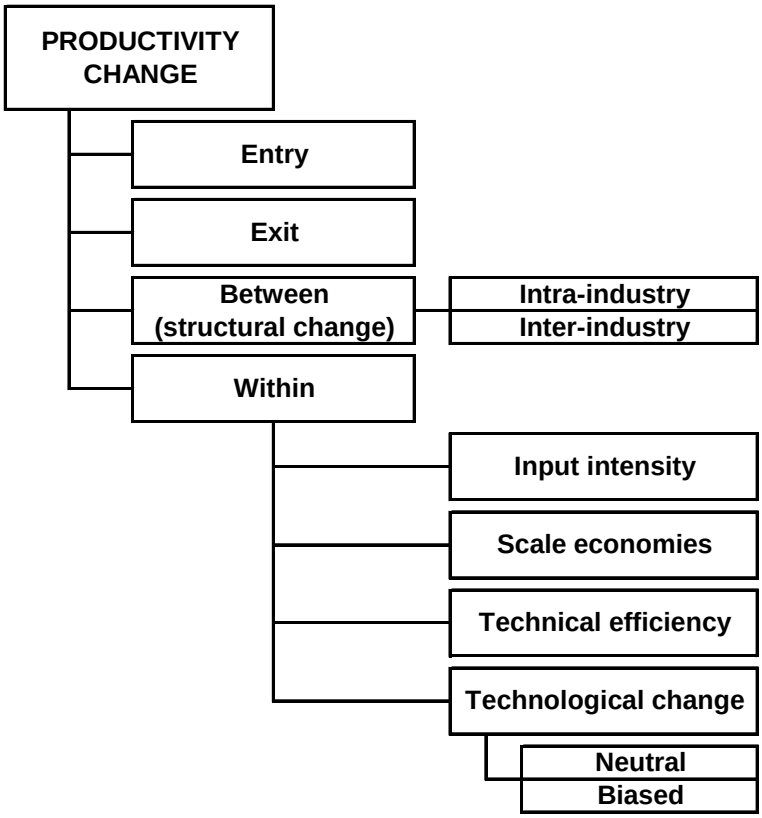

Table 1. Sources of productivity growth, 1983-2001

Period	Contribution to labor productivity growth (%)						Average annual growth (%)
	Within	Between		Entry	Exit	Total	
		Intra	Inter				
All firms							
1983-1988	0.70	0.15	-0.06	0.09	0.12	1.00	0.061
1988-1993	0.86	0.05	-0.01	-0.03	0.13	1.00	0.099
1993-1994	*-0.93*	*-0.08*	*-0.07*	*-0.11*	*0.19*	*-1.00*	*-0.063*
1994-1995	1.02	0.07	-0.12	-0.15	0.18	1.00	0.087
1995-2000	0.69	0.27	-0.21	-0.18	0.43	1.00	0.026
2000-2001	*-0.72*	*1.94*	*-0.63*	*-1.75*	*0.17*	*-1.00*	*-0.009*
SMEs							
1983-1988	0.04	0.04	-0.02	-0.05	0.06	0.08	0.018
1988-1993	0.20	0.00	-0.01	-0.06	0.07	0.20	0.085
1993-1994	*-0.19*	*-0.04*	*0.00*	*-0.10*	*0.16*	*-0.17*	*-0.043*
1994-1995	0.15	0.03	-0.02	-0.11	0.09	0.15	0.066
1995-2000	0.22	0.06	-0.05	-0.18	0.29	0.35	0.025
2000-2001	*-0.59*	*0.29*	*0.01*	*-1.34*	*1.38*	*-0.25*	*-0.021*
LSEs							
1983-1988	0.38	0.11	0.01	0.07	0.06	0.64	0.064
1988-1993	0.53	0.03	-0.02	0.00	0.05	0.59	0.107
1993-1994	*-0.42*	*0.02*	*-0.04*	*-0.02*	*0.03*	*-0.42*	*-0.052*
1994-1995	0.46	0.11	-0.08	-0.05	0.08	0.52	0.080
1995-2000	0.14	0.20	-0.13	-0.11	0.16	0.26	0.017
2000-2001	*0.58*	*1.35*	*-0.56*	*-0.51*	*1.11*	*1.96*	*0.025*
Foreign firms							
1983-1988	0.27	0.00	-0.05	0.07	-0.01	0.28	0.089
1988-1993	0.12	0.03	0.02	0.04	0.00	0.21	0.067
1993-1994	*-0.32*	*-0.06*	*-0.03*	*0.01*	*0.00*	*-0.41*	*-0.103*
1994-1995	0.41	-0.07	-0.03	0.01	0.00	0.32	0.146
1995-2000	0.32	0.01	-0.03	0.11	-0.02	0.39	0.034
2000-2001	*-0.72*	*0.30*	*-0.09*	*0.10*	*-2.31*	*-2.71*	*-0.071*

Table 2. Sources of within-productivity growth, 1983-2001

Period	Changes in input intensity (%)				Scale econ.	Tech eff.	Technological change		Average annual growth (%)
	Capital	Input	Energy	Labor comp.			biased	neutral	
All firms									
1983-1988	0.113	1.143	0.191	-0.020	0.014	-0.270	0.122	-0.294	0.033
1988-1993	0.017	0.542	0.066	0.005	-0.009	0.270	0.015	0.093	0.093
1993-1994	*-0.051*	*-0.409*	*-0.062*	*-0.001*	*-0.016*	*-0.735*	*0.000*	*0.274*	*-0.059*
1994-1995	0.073	0.724	0.112	0.013	0.006	0.103	-0.004	-0.027	0.057
1995-2000	-0.004	0.483	0.026	-0.016	0.021	0.660	-0.030	-0.140	0.018
2000-2001	*-0.034*	*-0.535*	*0.012*	*0.004*	*-0.025*	*-0.475*	*-0.016*	*0.068*	*-0.044*
SMEs									
1983-1988	0.055	1.237	0.135	0.001	0.005	-0.196	0.087	-0.324	0.022
1988-1993	0.021	0.625	0.065	0.001	-0.006	0.207	0.006	0.081	0.097
1993-1994	*-0.018*	*-0.751*	*-0.049*	*-0.003*	*-0.013*	*-0.563*	*-0.006*	*0.403*	*-0.095*
1994-1995	0.046	0.878	0.087	0.000	0.010	0.113	-0.008	-0.125	0.074
1995-2000	0.027	0.507	0.038	-0.001	-0.001	0.522	-0.016	-0.076	0.033
2000-2001	*0.018*	*-0.556*	*-0.035*	*0.002*	*-0.039*	*-0.395*	*-0.014*	*0.021*	*-0.071*
LSEs									
1983-1988	0.140	1.125	0.240	-0.030	0.017	-0.307	0.151	-0.337	0.036
1988-1993	0.011	0.493	0.077	0.008	-0.012	0.316	0.019	0.089	0.086
1993-1994	*-0.080*	*-0.029*	*-0.127*	*0.004*	*-0.019*	*-0.985*	*0.003*	*0.233*	*-0.030*
1994-1995	0.108	0.643	0.153	0.026	0.007	0.110	-0.002	-0.046	0.031
1995-2000	-0.075	0.300	0.017	-0.031	0.047	0.929	-0.034	-0.153	0.007
2000-2001	*-0.050*	*-0.495*	*0.051*	*0.006*	*-0.020*	*-0.563*	*-0.011*	*0.082*	*-0.035*
Foreign firms									
1983-1988	0.139	1.030	0.073	-0.020	0.021	-0.305	0.070	-0.009	0.039
1988-1993	0.040	0.589	0.019	0.000	0.004	0.175	0.011	0.162	0.124
1993-1994	*-0.037*	*-0.784*	*0.105*	*-0.011*	*-0.015*	*-0.365*	*0.001*	*0.106*	-0.099
1994-1995	0.017	0.756	0.042	-0.005	0.002	0.077	-0.003	0.114	0.150
1995-2000	0.151	1.058	-0.013	-0.021	0.011	0.250	-0.072	-0.364	0.028
2000-2001	*-0.184*	*-0.855*	*-0.123*	*-0.017*	*0.019*	*0.022*	*-0.085*	*0.222*	-0.007

Table 3. Descriptive statistics
(period averages)

	1983-1988	1989-1993	1994-2001
Output/employee ratio	1238	1847	2421
Value added/employee ratio	516	778	978
Import penetration ratio	0.140	0.141	0.195
Export intensity ratio	0.244	0.218	0.341
Tariff rate	0.241	0.177	0.109
Sectoral share of foreign firms	0.092	0.130	0.155
Regional share of foreign firms	0.118	0.166	0.185
Regional concentration index	0.205	0.219	0.218
Firm size	103	104	97
Real wages	77	132	136
Subcontracted input share	0.020	0.030	0.035
Subcontracted output share	0.026	0.034	0.044

Table 4. Determinants of labor productivity, 1983-2001
(fixed effects model)

	All observations		Domestic firms		Foreign firms	
Import penetration ratio	0.2188**	0.1921**	0.2230**	0.2021**	-0.2383	-0.1232
	[0.0378]	[0.0415]	[0.0384]	[0.0423]	[0.2415]	[0.2468]
Export intensity ratio	0.0409**	-0.0121	0.0397**	-0.0106	0.075	-0.0273
	[0.0131]	[0.0146]	[0.0132]	[0.0147]	[0.1021]	[0.1063]
Tariff rate	-0.5533**	-0.4209**	-0.5386**	-0.4095**	-0.6893**	-0.5528**
	[0.0203]	[0.0228]	[0.0207]	[0.0233]	[0.1228]	[0.1297]
Sectoral share of foreign firms	-0.0194	-0.043	-0.0637	-0.0840*	0.4932**	0.5817**
	[0.0330]	[0.0354]	[0.0342]	[0.0368]	[0.1323]	[0.1322]
Regional share of foreign firms	-0.1445**	-0.1700**	-0.1665**	-0.1827**	0.4241	0.3686
	[0.0432]	[0.0474]	[0.0441]	[0.0486]	[0.2228]	[0.2292]
Regional concentration index	-0.1763**	-0.1471**	-0.2041**	-0.1730**	-0.1916	-0.1173
	[0.0394]	[0.0425]	[0.0405]	[0.0439]	[0.1869]	[0.1901]
Firm size (t-1)		-0.0133**		-0.0138**		-0.0858**
		[0.0050]		[0.0052]		[0.0273]
Real wages (t-1)		0.2517**		0.2466**		0.2084**
		[0.0053]		[0.0054]		[0.0260]
Subcontracted input share		0.1021**		0.1065**		-0.0665
		[0.0309]		[0.0315]		[0.1658]
Subcontracted output share		-0.2006**		-0.2013**		-0.1962
		[0.0185]		[0.0187]		[0.1491]
# observations	185339	150301	180545	146058	4794	4243
# firms	28045	22997	27708	22674	781	711
Log likelihood	-177370	-138611	-172629	-134736	-3882	-3186

Note: Standard errors are in parantheses. All models include time dummies.

** (*) means statisticallu significant at the 1% (5%) level.

Table 5. Determinants of labor productivity, 1983-2001
(fixed effects model, only "mature" firms)

	All observations		Domestic firms		Foreign firms	
Import penetration ratio	0.2347**	0.2050**	0.2329**	0.2102**	-0.0195	-0.0319
	[0.0416]	[0.0444]	[0.0424]	[0.0453]	[0.2581]	[0.2616]
Export intensity ratio	0.0388**	-0.005	0.0359*	-0.006	0.0843	0.0137
	[0.0149]	[0.0158]	[0.0150]	[0.0160]	[0.1183]	[0.1185]
Tariff rate	-0.5556**	-0.4040**	-0.5383**	-0.3927**	-0.7703**	-0.5923**
	[0.0222]	[0.0242]	[0.0226]	[0.0247]	[0.1353]	[0.1411]
Sectoral share of foreign firms	-0.0609	-0.0771*	-0.1110**	-0.1230**	0.5439**	0.5518**
	[0.0357]	[0.0374]	[0.0371]	[0.0389]	[0.1365]	[0.1364]
Regional share of foreign firms	-0.1868**	-0.2170**	-0.2010**	-0.2234**	0.3022	0.2054
	[0.0478]	[0.0509]	[0.0488]	[0.0521]	[0.2463]	[0.2491]
Regional concentration index	-0.2149**	-0.1513**	-0.2356**	-0.1740**	-0.3117	-0.137
	[0.0434]	[0.0454]	[0.0447]	[0.0468]	[0.1977]	[0.2011]
Firm size (t-1)		-0.0203**		-0.0195**		-0.1199**
		[0.0056]		[0.0058]		[0.0316]
Real wages (t-1)		0.2641**		0.2594**		0.2059**
		[0.0059]		[0.0060]		[0.0281]
Subcontracted input share		0.1331**		0.1404**		-0.0994
		[0.0351]		[0.0357]		[0.1940]
Subcontracted output share		-0.2098**		-0.2130**		0.0337
		[0.0208]		[0.0211]		[0.1724]
# observations	138896	125267	135116	121660	3780	3607
# firms	19490	18413	19206	18128	600	588
Log likelihood	-130486	-114484	-126961	-111282	-2898	-2650

Note: Standard errors are in parantheses. All models include time dummies.

** (*) means statisticallu significant at the 1% (5%) level.

"Mature" means at least 5 years 0-4 years old.